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TUBERCULOSIS OF LYMPH NODES *

FREQUENCY, ORIGIN, AND RELATION TO OTHER TUBERCULOUS LESIONS, ESPECIALLY PULMONARY TUBERCULOSIS

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The lymphatic system has important functions as shown so clearly in inflammation. In acute local inflammation local and later general swelling of lymph nodes is one of the first most pronounced and most important phenomena. The swelling consists in a proliferation of all the elements of the node, most markedly of the lymphocytes and leukocytes, and a production of immune bodies directed against the infection locally as well as generally. There are chemical affinities between microbes and their products and the cells of the lymph nodes, especially the leukocytes, and the struggle — the neutralization of the injurious effects — in the first instance takes place in the regional lymph nodes; later it extends to the nodes in general.

The same process occurs in chronic inflammations. This is shown most clearly in syphilis, the progress of which can be followed from place to place by study of the lymph nodes; first, there is a hyperplasia of the local lymph nodes, and when the infection has become generalized, there is a swelling of the lymph nodes generally. In leprosy, swelling of the lymph nodes is one of the first changes, and the nodes are the most important depots for the leprosy bacilli and become such so early, especially in the abdomen, that one might be led to assume that they are the first tissues to be attacked after the bacillus has passed through either the skin or mucous membranes, at the same time as the bacilli surely may persist in a latent condition in the nodes for years. At all events the leprous process in the lymph nodes is a very chronic process and a very important localization.

In actinomycosis the conditions are different; it seems as if the actinomyces has little or no affinity for the lymphatic system. There is only little swelling of the lymph nodes in actinomycosis, and the fungus is hardly ever found in the nodes. It also appears that in the course of actinomycosis there is but a small number of immune bodies produced.

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In tuberculosis, on the other hand, the reaction in the lymph nodes is frequent and marked, just as in leprosy, the bacillus of which in many respects resembles the tubercle bacillus. Tuberculosis has a pronounced affinity for the lymph nodes, especially in childhood. In general, one may say that in children most of the tuberculous infections have their point of departure in tuberculosis of the lymph nodes; the tubercle bacillus is deposited here after it has passed through mucous membranes or the skin; here they proliferate enormously or remain latent but virulent for a long time, years and years, eventually escaping and infecting other organs. Most frequently the dissemination occurs by the lymph vessels, but also by the blood vessels and probably more often than now believed.

I now wish to discuss again tuberculosis of the lymph nodes and to use for that purpose the material which has accumulated in this institute during the last 12 years (1904-1915). This article is consequently a continuation of my larger article in 1905.[1] I wish to carry my investigations further and to discuss certain definite forms of tuberculosis of lymph nodes, more particularly the general form, its frequency in children and adults, its origin and importance as a cause of death. The common tuberculosis of the lymph nodes of the neck and of the bronchial lymph nodes is well known, but that tuberculosis of lymph nodes may be a general disease, that is, one which affects the whole lymph node system, is less well known; and yet it is not rare to find the lymph nodes tuberculous in all the most important groups, in the neck as well as in the chest and abdomen, and this occurs both in children and adults. This condition may be encountered incidentally in postmortem examinations; or, as is more commonly the case, it occurs in extensive, and as a rule eventually fatal, cases of tuberculosis, in which the process in the lymph nodes is the older and primary lesion, which as a rule causes tuberculosis in other organs and thus indirectly causes death.

Another point to be discussed especially is the connection between tuberculosis of the lymph node and tuberculosis in other organs, particularly with reference to pulmonary tuberculosis later in life, for the purpose of consideration from the anatomic point of view of the frequency of the so-called endogenous reinfection and tuberculous immunity, a problem that now is of special interest.

My observations are based on 2906 necropsies in 1904-1915, of which 2489 were of adults, that is, persons over 15, and 417 of children, that is, persons under 15. Of these cases, 431, 14.8%, died of tuberculosis; including advanced tuberculosis in persons dead from other causes, we should have 501, that is, 17%. Of the adults, 351, 14%, died of tuberculosis; of the children, 80, or 19%. In 203 cases considerable tuberculosis of the lymph nodes was found, that is, in 7%, 127 cases, 5%, being in adults, and 76, 18.2%, in children.

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[1] Jour. Infect. Dis., 1905, 2, p. 142.

Tuberculosis of lymph nodes falls into the following groups:

1. *Tuberculosis of the Bronchial Lymph Nodes.*—This constitutes a large group of primary tuberculosis of lymph nodes, including as it does, the bronchial lymph nodes, as well as the trachea and those in the hilus of the lungs. There were 57 cases of this form in all; in 8, however, the primary nature is uncertain; 38 occurred in adults and 19 in children, and all were fatal except 2. In most of the cases death resulted from a secondary miliary tuberculosis or tuberculous meningitis; this occurred in 16 adults and 14 children. In addition, there was often spondylitis, a mild pulmonary affection, and especially intestinal ulcer, which would seem to point to an additional infection by some other route.

A second large group of deaths are due to extensive secondary processes in the lungs, both in children, in whom it often is possible to demonstrate the direct point of entrance, and in adults; in this series there were 7 cases in children and 8 in adults. In many of these cases the clinical history gave previous 'glands in the neck,' of which there were no traces at necropsy. In these cases there was also tuberculosis in the bones and genital organs or disseminated miliary tubercles.

A third group includes secondary tuberculosis in bones, serous membranes, especially of the pleura or in the genitals (4 cases in adults) with small foci in the lungs, frequently at the same time.

There were 2 cases only of a latent tuberculosis of the bronchial lymph nodes.

A woman, aged 24, believed to have typhoid fever was found to have an extensive tuberculosis in the lymph nodes, in the thorax, and also pleuritis and salpingitis.

2. *Primary Extensive Tuberculosis in the Cervical Lymph Nodes.*—There were 10 cases, all in adults: 1 case in a girl, aged 15; 1 in a boy, aged 16; 5 in persons between 20 and 30, and the remaining 3 in persons aged, respectively 43, 45, and 50. Eight died of tuberculosis. In 2 the cervical tuberculosis was found incidentally. In 1 of the cases there was association with inveterate pulmonary tuberculosis. Of the

8 fatal cases, 2 died of miliary tuberculosis and 5 of secondary pulmonary tuberculosis, at times associated with intestinal and osseous tuberculosis. The 8th fatal case, which is of special interest, concerns a woman, aged 43, with lymphosarcoma in the abdomen, mediastinum, the glands of the neck, and metastases in different organisms. In addition there was tuberculosis in the lungs and in the lymph glands of the neck confirmed by inoculation of guinea-pigs.

Primary tuberculosis of the cervical nodes is comparatively rarely demonstrated, and it should be borne in mind that tuberculosis here frequently passes away without leaving any signs. This may also be true in extensive and widespread tuberculosis in other groups of lymph nodes in which it is learned that the disease began with swelling of the cervical nodes; anatomically, there may be no trace.

3. *Old Primary Extensive Tuberculosis in Abdominal Lymph Nodes.*—Here we have only 9 cases, in 7 adults and 2 children, only 3 dying of tuberculosis, 2 adults and 1 child, the others being found incidentally. In the cases in which the patients died from tuberculosis there were localizations in the bones, the urogenital tract, and the adrenals. As indicated, small old tuberculous changes frequently found in these groups of glands are not included.

Of special interest is the case of a woman, aged 78, who had had chronic obstruction for many years, and 6 years before death digestive difficulties and abdominal pains, and during the last year of life abdominal pain again and attacks of fever; finally a pulmonary process and pleuritis developed. Caseous and calcified lymph nodes were found in large numbers in the abdomen, and a recent tuberculosis of the lungs and pleura.

4. *Extensive Old Chronic Lymph-Node Tuberculosis in the Neck and Chest.*—This group contains 40 cases, of which 3 are doubtful; 20 occurred in adults and 20 in children. In 23, 9 adults and 14 children, the process caused death, and in 17, 11 adults and 6 children, the process was found incidentally. Of the 23 who died from tuberculosis, 9 (2 adults and 7 children) died of a secondary lung tuberculosis, 7 (2 adults and 5 children) of miliary tuberculosis and tuberculous meningitis, 2 (1 adult and 1 child) of tuberculosis of the serous membranes, 1 child of spondylitis, 1 adult of intestinal tuberculosis, 2 adults of urogenital tuberculosis, and 1 of secondary amyloid degeneration. Of the 17 cases found incidentally, there were several, both in adults and in children, in which the tuberculosis of the thoracic nodes appeared

to be an old affection, while the cervical tuberculosis appeared comparatively recent, perhaps an expression of infection through different paths and at different times.

It may be of interest to mention a few individual observations:

A man, aged 38, who had 'glands in the neck' in youth, developed tuberculosis in the lungs and larynx, and a retropharyngeal tuberculous abscess. There were large caseous lymph nodes in the neck and chest.

A man, aged 19, had suppurating glands as a child; he died of pulmonary and intestinal tuberculosis. There were large caseous glands in the neck and chest.

A woman, aged 35, died of miliary tuberculosis after having had 'glands in the neck' for 16 years. There were old tuberculous nodes in the hilus of the lungs.

A woman, aged 48, died of amyloid degeneration and extensive thrombosis. In the neck were large continuous masses of old tuberculous lymph nodes, similar masses also in the chest and an old pulmonary tuberculosis, descending tuberculosis of cervical nodes.

5. *Primary Contemporaneous Old Tuberculosis in Cervical and Abdominal Lymph Nodes.*—Of the 4 cases in this group, 1 was fatal (adult), while the other 3 were discovered incidentally (2 adults and 1 child).

A boy, aged 13, died rather suddenly of diphtheria. He had been treated for 'glands in the neck', and tuberculous ulcers were found on the leg, and near the anus, and also tuberculosis in the lymph nodes of the neck, the groin, and the pelvis.

A boy, aged 16, died of poisoning with resorcin. He had tuberculosis in the cervical and mesenteric lymph nodes.

A woman, aged 30, had ulcers on the legs for 10 years; also enlarged glands in the neck, anemia, albuminuria, and finally lung symptoms and enteritis. There were found tuberculous ulcers in the intestine, a small tuberculous focus in 1 lung and extensive amyloid change; numerous firm nodes in the neck from the jaw to the clavicle, the largest the size of walnuts, and a similar old caseous tuberculosis in the lymph nodes in the abdomen, retroperitoneally, in the hilus of the liver, in the hilus of the spleen, about the stomach, and in the mesentery. Presumably an infection of the lymph nodes of the neck and abdomen had taken place years back.

6. *Extensive Inveterate Tuberculosis of the Thoracic and Abdominal Lymph Nodes.*—This group includes 22 cases, 17 in adults, of which 14 were fatal, and 5 in children, aged 12-14 years, were all fatal. The cause of death was miliary tuberculosis, 1 adult and 1 child; primary (?) intestinal tuberculosis, 2 adults and 2 children; urogenital tuberculosis (3); tuberculosis in the adrenals with Addison's disease (3); tuberculosis of serous membranes (1); secondary (?) pulmonary tuberculosis (3); tuberculosis in bone, pericarditic pseudocirrhosis in a boy of 13; and a peculiar symptom complex with fever and anemia,

The last case occurred in a woman, aged 30 or 40, who suffered for half a year with fever and increasing anemia. There was a small calcified focus in 1 lung. Along the arch of the aorta there were several caseous lymph nodes of the size of chestnuts. Similar caseous nodes were in the hilus of the spleen and vicinity. There was a large spleen with numerous pea-sized tuberculous foci; and there were also numerous tubercles in the liver.

It seems most reasonable to regard the localizations in these 2 large groups of lymph nodes as closely connected and as a rule not due to independent infection.

7. *General Lymph-Node Tuberculosis.*—This is the most important group, and includes 61 cases, those of 32 adults, and 29 children.

Of the cases in children, 20 occurred during the first 3 years of life, and in almost all there was tuberculosis in the immediate relatives, most often in the parents. There were cases in older children, 4 in children aged 14. At the same time extensive tuberculous processes were found in internal organs, so that it usually was impossible to trace the connection, but the process in the lymph nodes was clearly the most marked and oldest. In all these cases, with 1 exception (Case 25) tuberculosis was the cause of death.

1. Child, aged 1½, died of intestinal tuberculosis and tuberculosis of the hip joint. There was a marked general lymph-node tuberculosis, apparently oldest and most advanced in the thoracic nodes, with extension to the lung and caseous pneumonia.

Presumably this was a case of primary tuberculosis in the thoracic lymph nodes, or possibly an intestinal tuberculosis, or a simultaneous infection in the chest and abdomen.

2. Girl, aged 14, whose mother died of consumption, had 'glands' for many years, and died of amyloid. There was an extensive old and continuous lymph node tuberculosis on both sides of the neck with adhesion to the lungs, in the posterior and anterior mediastinum, hilus of the lungs, and along the bronchi; also old tuberculous intestinal ulcers, with tuberculosis of the corresponding lymph nodes. There were, furthermore, small indurated tuberculous foci in the apices of the lungs, tuberculous endometritis and salpingitis, and amyloid degeneration.

This no doubt was a primary tuberculosis in the cervical lymph nodes, with extension (?) to the glands in the chest, either by continuity or by way of the circulation.

3. Child, aged 4, had chronic trouble in the eyes and nose, and disease of the intestines for about 2⅓ years. An old intestinal tuberculosis, especially in the cecum with tuberculous peritonitis, was found and also a general lymph node tuberculosis of earlier origin. In the posterior mediastinum, the apex of 1 lung was adherent to a lymph node and a small tuberculous focus and cavity had formed. There was also miliary tuberculosis, tuberculous menin-

gitis, large tuberculous masses in the brain, and tuberculosis of the endocardium and the left ventricle.

In this case the intestinal tuberculosis was probably the oldest process and may have given rise to the tuberculosis in the lymph nodes.

4. A child, aged 10 months, had large caseous masses in the anterior mediastinum, along the trachea, in the hilus of the lungs and also along the bronchi, with rupture of a bronchus, and focus in the lung; some small tuberculous nodes in the neck and the retroperitoneal tissue; and large masses in the mesentery.

This was probably a case of primary tuberculosis in the thoracic lymph nodes without direct connection with other groups of nodes.

5. Child, aged 5, who had had persistent bronchitis since 3; had cavernous pulmonary tuberculosis, tuberculosis of the intestines and of the largest lymph-node groups in the neck, the chest, and abdomen. Nothing can be said about the connection.

6. Artificially nourished orphan, aged 1 year, had cavities in the lungs, and large tuberculous masses in the lymph nodes of the chest, neck, and abdomen. Nothing definite can be said about the course of events.

7. Child, aged 2¾ years, presented a marked general tuberculosis with perforation of a bronchus and a small pulmonary focus. Apparently there was a primary lymph-node tuberculosis of about the same extent everywhere.

8. Child, aged 1 year, whose mother died of tuberculosis, had diarrhea and then lung symptoms. There were a marked general lymph-node tuberculosis, with perforation in 1 lung, tuberculous ulcers in stomach and intestine, and scattered miliary tubercles.

The lymph-node tuberculosis was probably primary, but whether it developed from several points or spread from 1 group could not be determined.

9. Child, aged 10 months, had meningitis and miliary tuberculosis. There was general tuberculosis of the lymph nodes of the neck (comparatively recent), along the trachea, in the hilus of the lungs, and along the bronchi; also in a retroperitoneal gland, but not in the mesentery.

In this case the tuberculosis in the thoracic nodes undoubtedly was the oldest and spread to the other groups.

10. Child, aged 1⅓ years, died of miliary tuberculosis and tuberculous meningitis. There was a general lymph-node tuberculosis, most marked in the chest and neck and undoubtedly primary in 1 or the other.

11. Child, aged 2 years, had tuberculous ulcers in the intestines and a large tuberculous growth in the cerebellum; furthermore, tuberculosis in the lymph nodes of the neck and chest, larger in the thorax, and also in the mesentery.

As the process was oldest and most marked in the chest, it is possible that the infection in the neck was secondary thereto.

12. Child, aged 7 months, had a marked tuberculosis of the lymph nodes, most pronounced in the mesentery and behind the peritoneum; next on both sides of the neck and in the axillae, and in the chest. There was also a beginning pericarditis and pleuritis and some scattered tubercles in internal organs.

The process was most marked in the abdomen, and possibly primary here, the dissemination being either by the lymph vessels or possibly by the blood vessels.

13. Child, aged 1½ years, had chronic intestinal symptoms for some time. There was marked old tuberculosis of lymph nodes, most advanced in the

neck, but present also along the trachea and bronchi, and in the abdomen. There were also tuberculous intestinal ulcers, meningitis, and a tuberculous focus in 1 lung.

In this case the process was oldest in the neck and chest and in the intestines; but the course of events was not clear.

14. Child, aged 1½ years, whose mother was tuberculous, died of pulmonary and intestinal tuberculosis and had an extensive process in the glands of the neck, chest, and abdomen.

15. A child, aged 8 months, had general lymph-node tuberculosis, there being large caseous nodes in the neck, largest in the upper part, also in the chest and abdomen, and a large tuberculous focus in 1 lung in direct connection with tuberculous bronchial lymph nodes. There was no intestinal tuberculosis.

The process was most marked and probably earliest in the neck and chest; the abdominal process was probably secondary.

16. A girl, aged 9 years, whose mother was consumptive, died of miliary tuberculosis and tuberculous meningitis. There were some fibrous tuberculous nodes in the neck, in the hilus of 1 lung, and in the mesentery, also tuberculous ulcers of the intestine.

Here was a disseminated, partly localized tuberculosis in different groups of lymph nodes. The intestinal ulcer could hardly be a point of origin for all these localizations, which probably arose from distinct infections at different times.

17. Child, aged 8 months, both of whose parents were tuberculous had caseous lymph nodes in the neck, numerous large caseous nodes in the chest, in the mesentery, and also retroperitoneally; secondary pulmonary tuberculosis and recent tuberculosis in the intestine.

In this case the lymph-node process was surely primary, and the lymph nodes in the chest appear to have been most affected.

18. Girl, aged 8 months, whose mother was consumptive, died of miliary tuberculosis. There were large caseous glands in the neck, chest and abdomen, a pronounced primary lymph-node affection, but not continuous.

19. Girl, aged 14 years, had 'glands' when young and tuberculous peritonitis 2 years before death. There were cavernous pulmonary tuberculosis and caseous pneumonia, intestinal and peritoneal tuberculosis, and caseous lymph nodes, especially in the neck, but also in the chest and abdomen.

On account of the extensive changes, the connection between the different processes could not be determined, but the history indicated an early lymph-node tuberculosis.

20. Boy, aged 5 years, had 'glands' for many years with open scars and sores, finally, enlargement of the abdomen, a general lymph-node tuberculosis with caseation, the masses in the abdomen being especially large, also a severe pulmonary and intestinal tuberculosis.

While no definite statement can be made as to the connection, the history pointed to an early tuberculosis in the lymph nodes.

21. Child, aged 7½ months, whose mother died of galloping consumption when the child was 4 years old, had an extensive tuberculosis in the thoracic lymph nodes, with rupture into a bronchus and caseous pneumonia. In addition, there were smaller tuberculous nodes in the abdomen and in the neck, and miliary tubercles in different organs.

It would seem reasonable to assume that in this case the tuberculosis of the thoracic nodes was the oldest and gave rise to the processes elsewhere.

22. Boy, aged 3 years, had caseous lymph nodes on both sides of the neck, extending from above into the thorax, being connected directly with similar caseous masses along the trachea, in the hilus of the lungs and along the bronchi. There were perforation of a bronchial node with a local pulmonary focus, caseous lymph nodes in the mesentery and behind the peritoneum, scattered miliary tubercles, and a large conglomerate mass in the cerebellum.

There may have been a direct connection between the process in the neck and chest, but separate infection at different times was also possible.

23. Girl, aged 6 years, had general lymph-node tuberculosis, caseous nodes on both sides of the neck, along the trachea, in the hilum of the lung and along the bronchi, perforation of the bronchus, pulmonary and intestinal tuberculosis, and caseous masses in the mesentery.

Nothing definite can be said about the connection. The process in the neck seemed to be of long standing, and the mesenteric nodes may have become infected from the intestine.

24. Boy, aged 2 years, had extensive lymph-node tuberculosis in the usual places in the chest, with caseation and perforation of the right bronchus, and secondary lung tuberculosis; caseous lymph nodes in the lower parts of the neck and in the abdomen; and tuberculous meningitis. It appeared as if the lymph nodes in the chest were involved to the greatest extent, and possibly primarily.

25. Child, aged 15 months, whose mother died of tuberculosis, had hydrocephalus, extensive lymph-node tuberculosis, especially in the chest and on both sides of the neck, smaller caseous nodes in the mesentery and inguinal region, miliary tubercles in the spleen and liver, and tuberculous ulcer in the ileum. The oldest process seemed to be that in the neck and chest, but there was no direct communication between these groups.

26. Girl, aged 14 years, whose father was probably tuberculous, died of miliary tuberculosis, having had pleuritis 2 years back and steadily growing glands in the neck for the last 8 months of life. There were large masses of caseous lymph nodes on both sides of the neck, smaller ones along the trachea, in the hilus, and along the bronchi, with rupture into the lungs, and scattered pulmonary foci. There were caseous lymph nodes in the minor omentum and behind the peritoneum.

The process in the neck was most marked and of long standing. Apparently there was a direct connection between the process in the neck and in the chest.

27. Child, aged 1½ years, died of tuberculous meningitis. There was an extensive tuberculosis in the thoracic nodes, also less marked tuberculosis in the glands of the neck and mesentery.

In this case the thoracic nodes were undoubtedly affected primarily; probably the other nodes were infected by way of the blood.

28. Boy, aged 14 years, 4 of whose sisters and brothers died of tuberculosis, died of pulmonary tuberculosis. There were an extensive cavernous tuberculosis in the lungs, with gelatinous pneumonia, perforation of the bronchus by tuberculous node and fatal hemoptysis, intestinal tuberculosis, extensive old tuberculosis in the trachea, in the hilus and along the bronchi, and a few caseous glands in the neck and abdomen, both in the mesentery, as well as along the aorta and the iliac arteries.

The changes are so extensive that it is impossible to determine whether the thoracic lymph nodes or lungs were primarily infected.

29. Boy, aged 2 years, whose mother was tuberculous, died during hemoptysis. There were extensive cavernous tuberculosis with gangrene and empyema,

scattered miliary tubercles, and marked caseation in the lymph nodes in the neck, axillae, hilus of lungs, and abdomen.

The process in the lungs was so extensive that the primary point of origin could not be determined definitely, but probably the process in the lymph nodes was the primary one.

These cases show that the lymph nodes in the neck, in the thorax, and in the abdomen were markedly and extensively affected. Occasionally, there was also a similar process in the axillary and inguinal nodes. Frequently there was a descending process in the neck, most marked above, and reaching down into the supraclavicular spaces; next in the thorax along the trachea, least marked above, down to the bifurcation and pulmonary hilus where the masses usually were largest, and then along the bronchi. Apparently, there was a continuous series of infected lymph nodes, but it must be noted that the extent decreases downward in the neck and upward along the trachea.

In the abdomen there was generally a more isolated tuberculosis, either in the mesenteric nodes only or in the retroperitoneal nodes, sometimes in high degree and in the upper part of the abdomen, along the aorta, the celiac axis, or in the hilus of the liver and spleen.

Consequently, in general, it does not appear that the coarser anatomic conditions point to a continued and continuous spread along the lymph vessels from one point and from one place to another. In the case in which the process in the lymph nodes was found incidentally, it was marked in the thorax and the neck, but was only in the early stages in the mesenteric nodes. For the present no consideration is given to the question whether there are directly communicating channels between the different groups of lymph nodes.

On the other hand, the impression is frequently gained that a repeated infection by different paths and of different places may have occurred, especially when the glandular process clearly appears to be of different ages, old, perhaps obsolete, in one Long locality and recent in another which has no direct connection with the first. That this would frequently be the case is indicated also by the presence close at hand of a rich source of infection, such as a consumptive parent, so that the child is exposed to infection at different times by inhalation as well as by swallowing.

There remain a number of observations of extensive tuberculosis of the lymph nodes in all the regions, perhaps more marked in some particular group and, if so, usually in the chest or neck. Frequently the information is supplied that the disease began as an infection of the glands of the neck which has been observed through months and even years. In these cases one may assume either a continuous spread by way of the lymph vessels from group to group, which no doubt occasionally does take place, or a dissemination by way of the blood. After the bacilli have accumulated in considerable numbers in one place in the bodies of children, they soon spread very rapidly, at first mostly by the lymph vessels or directly into the blood vessels, including large veins. That this may be the course of events is shown by the general experience that hematogenic dissemination in internal organs regularly takes place, tuberculous meningitis or miliary tuberculosis being the end. As the lymph nodes are good culture grounds for the bacilli they soon become infected either directly from the blood stream or indirectly through the lymph from different organs infected by way of the blood. Such, no doubt, is frequently the course in children, especially young children.

In 1905 I[1] published a series of observations supporting the view now advanced; by microscopic examination and inoculation of guinea-pigs, I showed that a latent tuberculosis is often present in several groups of lymph nodes at the same time, especially in the bronchial and cervical groups, or in the bronchial and mesenteric, or in all 3 groups. Even old healed forms and fibrous and hyaline tubercles were found in all 3 groups in 2 children, aged 10 and 14, respectively. Latent bacilli were also frequently demonstrated in different groups of lymph nodes apparently normal, though a little enlarged; for example, simultaneously in the nodes of the neck and mesentery, less frequently in the nodes of the neck and chest, and 5 instances in all 3 groups.

Similar observations are recorded by de Besche,[2] who made systematic inoculations of lymph nodes, especially from the neck and mesentery in children. He found a simultaneous infection in no less than 33 cases in 46, that is, 70.4%, but as a rule, as distinct infections. He found a simultaneous general infection in 8 of 14 cases of latent tuberculosis and in 7 of 10 cases, in which there were latent tubercle bacilli.

Ungermann[3] inoculated lymph nodes systematically from the bodies of 171 children and obtained tuberculosis in 34, that is, 22.8%, 29 having died of tuberculosis, 10 had a latent infection, and in 4 there were latent tubercle bacilli without any anatomic changes. When a group of lymph nodes was found to be tuberculous, there was generally infection of the other 2 groups. The bronchial nodes were most extensively infected and apparently the infection there was of the longest standing. He found a general lymph-node infection in 30 cases, 76-77%. He assumes that as a rule the nodes in the chest are infected first or possibly the mesenteric nodes and that dissemination by the blood carries the infection to the other groups; further, that the nodes in the lower part of the neck may be infected by way of the lymph vessels from the nodes in the chest, but only in slight degree. Hematogenic infection is the rule, and most often from the thoracic nodes, which are infected again by way of the lymph vessels from the lungs following inhalation of tubercle bacilli.

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[2] Bakteriologiske studier over barnetuberkulose, Christiania, 1912.

[3] Tuberk.-Arb. a. d. k. Gsndhtsamte., 1912, No. 12, p. 213.

This is in harmony with my observations and probably applies to the cases of general lymph-node tuberculosis in childhood. A rapid extension occurs along the lymph vessels after 1 or more infections of different groups and then a hematogenic dissemination through the whole system and all groups of lymph nodes, which enlarge and become tuberculous, so that before long it is impossible to trace the route or mode of infection.

As to the cause of death in general lymph-node tuberculosis of children, it appears on the basis of this material that pulmonary tuberculosis is the cause of death in about one half of all cases, as so frequently is the case also in isolated tuberculosis of the bronchial nodes. Not rarely tuberculosis of the lungs assumes a phthisical form with cavities, as is often seen, particularly in older children, but not rarely in the first years of childhood and even in infancy. The lungs are attacked much less frequently through the coalescence of lymph nodes and the apices of the lungs, as may happen in the regions above the clavicles and in the upper part of the mediastinum. In certain cases it is impossible to decide whether the process of the lungs is the point of origin of the tuberculosis of the thorax and elsewhere.

In about one fourth of all of the cases tuberculosis in the intestinal tract is the principal lesion and cause of death, and presumably the primary infection developed as a tuberculosis in the abdominal lymph node with extension to the other groups of nodes.

Naturally, the cause of death often is a miliary tuberculosis or a tuberculous meningitis, which is the case in about one fourth of all the cases, as is so often the case in tuberculosis of the individual groups of lymph nodes.

Greater interest is aroused by general lymph-node tuberculosis in adults. In the years 1904 to 1915 I observed 32 cases, of which 30 were directly fatal and 2 were discovered incidentally. As there were 3489 necropsies in adults in this period, this is 1.3%. There were altogether 127 cases of extensive tuberculosis of lymph nodes, that is to say, 5% of all persons examined after death.

1. Man, aged 32, had pleuritis at the age of 14, and suffered from digestive disturbances for 4 years. There was an old and severe intestinal tuberculosis with strictures and extensively caseous lymph nodes in the mesentery and behind the peritoneum. There were caseous lymph nodes as large as walnuts in the supra-maxillary fossa along the neck muscles, the trachea, and in the hilus of the lungs. There was, finally, a pulmonary tuberculosis of comparatively recent date. It would seem likely that this was a case of general lymph-node tuberculosis starting in the abdomen.

2. A man, aged 29, died of a chronic tuberculosis of the lungs, with cavities. There were also tuberculosis in the larynx and intestine and an old general lymph-node tuberculosis in the chest, neck, and abdomen, but nothing definite could be determined as to the connection and extension.

3. A woman, aged 22, had, as a child, 'glands' and died after symptoms of lung tuberculosis for about 1 year. In addition to a cavernous process in the lung there was tuberculosis of the intestine and a general lymph-node process in the neck, some of the nodes being calcified, in the clavicular fossae, in the axillae, along the trachea and bronchi, and in the mesentery and retroperitoneal tissues, but the process was too far advanced to permit any definite inference as to the mode of extension, though the process in the neck was very old and a spread downward would seem possible.

4. Woman, aged 21, died of puerperal infection. Tuberculous lymph nodes the size of walnuts were present on both sides of the neck, in the left axilla, along the bronchi, but smaller there, also in the mesentery and behind the peritoneum, where they were completely caseous. This then is a case of general lymph-node tuberculosis most marked in the neck and abdomen, but anatomically not connected. Did the spread take place by way of the blood from the neck or abdomen or did infection occur by different routes at different times?

5. Woman, aged 30, was of a tuberculous family. In addition to pulmonary and intestinal tuberculosis and tuberculous peritonitis, there was an extensive tuberculosis of the lymph nodes in the neck, the chest, the axillae, and behind the peritoneum, largely caseous, but not continuous. The advanced caseation indicates that the process in the lymph nodes was old and probably primary.

6. Man, aged 18, had bronchitis and 'glands' in childhood, and died of tuberculosis of the lungs and intestine, with amyloid degeneration. There was an old, general tuberculosis of the lymph nodes in the mesentery and in the hilus of the lungs, along the trachea, as well as in the neck, with calcification and putty-like foci. The process was apparently very old, especially in the abdomen, and in the neck, and was possibly the point of origin of the other localizations.

7. Man, aged 22, died of acute pulmonary tuberculosis and miliary dissemination through rupture of a pulmonary vein. There was a caseous tuberculosis of the cervical nodes, of the nodes in the mediastinum, the hilus of the lungs, along the bronchi, and in the mesentery and behind the peritoneum. The process in the lymph nodes appeared to be the oldest process, especially in the neck and chest, but it was not continuous.

8. Girl, aged 16, who had tuberculous glands which were removed from the neck in childhood, died of miliary tuberculosis. There were also tuberculous intestinal ulcers, tuberculous pleuritis and extensive old tuberculosis of the thoracic lymph nodes with perforation of a pulmonary vein, and extensive tuberculosis of the mesenteric and retroperitoneal lymph nodes, in increasing degree toward the diaphragm, but there was no tuberculosis in the neck. In this case the process in the lymph nodes was primary, according to the history, probably in the neck; from the thorax it appeared to have spread to the abdomen.

9. Man, aged 27, had intestinal tuberculosis, tuberculous peritonitis and pleuritis, with small foci in the lungs, and an old tuberculosis in the lymph nodes of the chest, neck and abdomen, but not continuous. The process in the nodes was oldest and most marked in the chest.

10. Boy, aged 17, had cavernous tuberculosis of the lungs, intestinal tuberculosis, and a general, rather old tuberculosis of the lymph nodes, most marked in the thorax and behind the peritoneum. The process in the lymph nodes appeared to be primary.

11. Woman, aged 19, had tuberculosis of the lungs, larynx, and intestine, with an extensive process in the nodes of chest, neck, and abdomen. The age of, and relation between, the various processes was not clear.

12. Man, aged 22, had had digestive and intestinal disturbances since the age of 10. There was increasing swelling in the neck during the last 3 years, with emaciation. There were tuberculous strictures in the jejunum and caseation of the corresponding mesenteric nodes. There were caseous nodes low down in the neck, also enlarged bronchial nodes, and in 1 apex fibrocalcareous indurations surrounded by recent tubercles. This looked like a case of primary intestinal tuberculosis on which followed a process in the nodes, in the abdomen, and in the neck. While the process in the lung was old, it could hardly explain the extensive changes elsewhere.

13. Girl, aged 15 years, had extensive general lymph-node tuberculosis, especially in the neck, perforation of a bronchus with extension into the lung, and intestinal tuberculosis with ulcer. In this case the lymph-node infection was undoubtedly the oldest. It was most marked in the chest and neck, but not continuous in these regions.

14. Man, aged 27, who had an operation for 'glands' of the neck 3 years past, died of urogenital tuberculosis. There were hard putty-like nodes on the right side of the neck and in the chest and abdomen, largest in the abdomen (size of goose eggs), and tuberculous intestinal ulcers. Undoubtedly a primary lymph-node infection, probably oldest in the abdomen and neck, but without direct connection between these groups.

15. Woman, aged 44, who had 'glands' in childhood, died of enteritis and amyloid disease. There were found intestinal tuberculosis, tuberculous salpingitis, an old focus in 1 lung, and inveterate tuberculosis in the lymph nodes of the chest, neck and mesentery. The last was most likely the oldest lesion, but the relation between the processes in the different groups is not clear.

16. Man, aged 24, died of pneumonia. He had 6 operations for glands in the neck during his 12th and 13th years. Now the cervical nodes were caseous, size of almonds; the nodes in the hilus of the lungs were swollen with scattered fibrous tubercles and there were caseous nodes in the mesentery. There was an old general lymph-node process, but not continuous.

17. Woman, aged 27, with tuberculous abscess in Douglas fossa, was found to have a chronic peribronchial tuberculosis of the lungs, tuberculous ulcers in the intestine, and a genital tuberculosis. In the glands of the neck, chest, and abdomen was an old tuberculosis with caseous and puttly-like material, apparently older than the other processes. Whether it represented a continuous lymphatic dissemination could not be determined.

18. Woman, aged 30, of a tuberculous family, had broken down glands in childhood. She died of 'consumption', There was chronic tuberculosis in the lungs and intestine, tuberculous peritonitis and endometritis, and miliary tuberculosis. The glands in the neck, chest, and abdomen were tuberculous, and the history pointed to an early infection of the cervical glands, but the point of primary infection and the mode of spreading could not be determined anatomically.

19. Woman, aged 27, had 'glands' in childhood, tuberculous nodes in the axilla when 17, presternal tuberculous abscess when 20, spondylitis during the past 7 years, and died of amyloid. Necropsy showed that the tuberculosis in the neck had subsided completely, while in the chest and abdomen there were large caseous nodes. There is a possibility in this case that the infection spread from the cervical nodes.

20. Man, aged 36, died of miliary tuberculosis and meningitis. Besides a small pulmonary focus there were large masses of caseous lymph nodes in the neck, axillae, chest, and abdomen, and a tuberculous ulcer in the cecum, the process in the lymph nodes being apparently continuous.

21. Girl, aged 18 years, had tuberculous peritonitis and pleuritis with caseous foci in the lungs, and thoracic and retroperitoneal lymph nodes. The process in the lymph nodes could hardly be regarded as secondary to the pulmonary process.

22. Woman, aged 19, with a small focus in the right lung, tuberculous salpingitis, peritonitis, pleuritis, and pericarditis (commencing). There were caseous nodes in the chest, neck, and abdomen, the process being apparently independent in each group.

23. Girl, aged 18 years, whose father was tuberculous, had pleuritis 2 years past. There were extensive pulmonary involvement with cavities, tuberculosis of the larynx and intestine, and walnut-sized caseous masses in the neck, chest, and abdomen, showing an extensive and old lymph-node process.

24. Woman, aged 22, had tuberculosis in the cecum and colon, and a general lymph-node tuberculosis of long standing. The intestinal ulcer hardly sufficed to explain the process in the lymph nodes except perhaps by hematogenic dissemination from secondarily affected mesenteric nodes. On the other hand, infection may have taken place along different routes either simultaneously or at different periods.

25. Man, aged 24, died with cerebral symptoms due to a large tuberculous mass in the brain. There were tuberculosis of the lungs with small cavities, tuberculous pleuritis and peritonitis, and an extensive tuberculosis in the lymph nodes in the neck, chest, and abdomen, those in the thorax being most markedly involved and apparently the seat of the oldest changes.

26. Girl, aged 15 years, whose mother was tuberculous, had 'glands' which suppurated. She died of tuberculous meningitis. Besides meningitis, there were found an old pulmonary tuberculosis with scattered caseous and calcified nodules, a chronic ileocecal tuberculosis, and a general lymph-node tuberculosis of chronic character, as shown by calcification and caseation with softening.

Beginning in the neck and extending continuously downward was a series of nodules, bean-sized and larger, partly caseous, which were directly connected with similar nodules in the chest, along the spinal column, and in the hilus, as well as along the bronchi; in the latter place the nodules were completely calcified. The retroperitoneal nodes from the diaphragm down to Poupart's ligament were caseous and as large as walnuts; along the psoas muscles were softened masses with yellowish green pus. This seemed to be a typical example of a chronic general lymph-node tuberculosis, originating early in childhood, in which there was direct communication between the various groups involved. The old pulmonary process may have been of hematogenous origin and the intestinal tuberculosis pointed to a primary infection through the digestive tract.

27. Woman, aged 65, who died of chronic nephritis, had a mass of swollen glands with putty-like contents under the right side of the tongue, also along the trachea and along the aorta, the chest, and the abdomen. No connection between these different groups could be found.

28. Man, aged 25, besides tuberculous peritonitis showed tuberculosis in the lymph nodes, in the mesentery and in the chest, also a fresh tuberculous pleuritis. There was a small caseous focus in 1 lung and fresh tuberculous nodules in the cervical lymph nodes clearly of more recent date than the process in the chest and the abdomen.

29. Man, aged 24, who died of tuberculous meningitis, presented large caseous lymph nodes in the chest, in the supraclavicular regions, and also along the aorta behind the peritoneum, the process apparently having spread from the thoracic nodes both upward and downward.

30. Girl, aged 17, died of pulmonary tuberculosis. She had had enlarged glands in the neck for many years. In addition to a rather acute cavernous process in the lungs were found large caseous nodes in the neck, along the trachea, and in the hilus of both lungs, as well as in the hilus of the liver and in the omentum minus, the process being oldest in the neck. The infection of the lung may. be regarded as secondary.

31. Man, aged 22, had tuberculosis of the knee, and amyloid degeneration. There was an extensive old lymphatic tuberculosis beginning high in the neck and extending continuously down into the inguinal regions, the masses being as large as hen's eggs, hard and caseous. A softened mass in the posterior mediastinum had developed into a tuberculous abscess with erosion of the spinal column. A mass behind the peritoneum had grown fast to the stomach with perforation of the mucous membrane and the formation of a large ulcer with undermined edges and caseous spots in the bottom. There were also a cavernous pulmonary tuberculosis and tuberculous intestinal ulcers. In this case the process in the lymph nodes, which appeared to be continuous, clearly was of the longest standing.

32. Man, aged 25, with 'glands' in the neck since very young, had tuberculous meningitis. There were an extensive old lymph-node tuberculosis with marked caseation from high up in the neck down through the chest and abdomen, and into the inguinal regions, miliary tuberculosis, tuberculous ulcers in the intestines, and a small caseous area in the lung. This was undoubtedly a primary general lymph-node tuberculosis.

33. Man, aged 25, had 'glands' in the neck since childhood; in the summer of 1915 a swelling in the left side of the neck appeared, which grew steadily. In 1916 the diagnosis malignant granulomatosis was made; there was pigmentation in the skin of the face and the hands, and a considerable swelling

on both sides of the neck in the form of hard, solid masses; there were also signs of trouble in the lungs. The patient died in April, 1916. On both sides of the neck were conglomerate masses of enlarged lymph nodes, the largest above and behind, the smallest below in direct connection with similar masses along the trachea and in the hilus of the lungs. The masses were hard, homogeneous, and yellowish white on cut surface. The retroperitoneal lymph nodes were changed in the same way, being largest under the diaphragm and decreasing in size downward along the aorta and the iliac arteries. In the lungs were conglomerate masses of tubercles, especially large and numerous in the upper lobes; 1 such mass had softened and pyopneumothorax had resulted; there were 2 large tuberculous masses in the kidneys. The history and necropsy point to an old process in the lymph nodes which became almost general; possibly it began in the neck in childhood and extended by continuity along lymph vessels to the chest and the abdomen; the lesions in the lung may well have been hemotogenic as were those in the kidney.

On reviewing these cases of general lymph-node tuberculosis in adults the question at once arises, how do they originate? Do they arise at the same time or at different times, through infection by different paths? Do they spread from one place to other places by lymph vessels or blood vessels? What are their effects, especially with reference to secondary pulmonary tuberculosis or other fatal localizations?

Undoubtedly, many cases arise from invasions along different paths and probably often also at different times. This is especially true when the affection of the lymph nodes is incomplete, even when present in the neck as well as in the chest and abdomen, that is, discontinuous; in the next place, when the affection clearly is of different age in different places, that is to say, has ceased to advance in one place, for example, in the neck, while there are fresh tubercles in another place. Such conditions may be quite distinctly recognizable when the general lymph node affection is discovered incidentally and is relatively easily analyzed. The source of infection may be clear, such as tuberculosis in the father or mother, so that repeated infection may have taken place easily. There are many cases of this kind, but they do not form the majority of the cases of general lymph-node tuberculosis in the strict sense. These appear somewhat differently macroscopically — one finds, in brief, a generally disseminated, apparently continuous tuberculous enlargement of the lymph nodes everywhere, at all events in all the larger groups which generally are examined; and usually the process is of long standing, that is to say, the lymph nodes are considerably enlarged, usually hard, solid, more rarely soft, in which case the disease assumes more acute forms with fever, anemia, etc., with here and there calcareous infiltrations, but especially caseation in high degree; the masses vary, being sometimes even as large as hen's eggs and even larger, as for instance in the retroperitoneal space, the hilus of the lungs, or high up in the neck.

In the neck the lymph nodes are usually largest above and behind, beneath and behind the lower jaw, diminishing as one goes downward, but present lower down to the clavicular and supraspinous fossae and at superior thoracic aperture, and also often in the axillae. In the chest, the swelling extends along the whole trachea apparently in continuity with the swelling in the neck, but with increasing size as one goes downward, the largest nodes being found at the bifurcation of the trachea and in the hilus of the lungs; the enlarged bronchial nodes decrease steadily toward the lungs. In the mesentery may be enlarged nodes, with or without ulcers in the intestine, but usually not of any great size; retroperitoneally there may be many large swellings, along the aorta, especially behind the stomach and pancreas; in the hilus of the liver and of the spleen the masses may be large also; they may extend along the aorta to the diaphragm, apparently directly continuous with the masses in the lymph nodes of the chest, along the trachea and esophagus; downward they extend along the iliac vessels to the inguinal region, but decreasing in size.

The question now arises as to how the infection took place in the cases in which the whole lymph node system is affected and apparently continuously. It is close at hand to conclude that it is a continuous extension along the lymph vessels from a point of origin in some group of lymph nodes. Thus it might be an extension from a primary tuberculosis in the lymph nodes of the neck, in favor of which would be the information frequently given in the history that, as a child, the patient had 'glands of the neck' with marked swelling and often suppuration with sometimes repeated operations. Such information was given in 12 of the 32 cases here considered. The direct connection between the lymph nodes of the neck and the chest and of those above and below the diaphragm would also seem to favor the view that it is a primary cervical localization. Within each principal localization (neck, chest, and abdomen) the extension as a general rule would seem to be a continuous one, for example, from the hilus of the lungs out along the bronchi. Is there really such mode of communication that it is possible to have the direct connection and extension asserted especially by Weleminsky?[4] In this connection it may be pointed out that the lymph current frequently is reversed in pathologic processes in a particular region. Furthermore, that there is more or less analogy in the extension of malignant tumors, as for instance, the extension of carcinoma apparently continuously from the abdomen into the chest and from the chest into the neck, at any rate to the supraclavicular lymph nodes (Most).

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[4] Fourth International Congress on Tuberculosis, Rome, 1912.

The majority of those who have studied this problem, however, have reached the result, which harmonizes better with the anatomic facts, that every organ and every organ system has its own lymphatic system which communicates with other systems only on the borders and through comparatively small channels (Most, Kitimura, Beitzke, Hart, E. Albrecht). It is conceded, which is in harmony with experimental results, that the lowermost lymph nodes in the neck may be infected from the chest, and that the abdominal, especially the retroperitoneal, may be infected from the chest, and vice versa (H. Albrecht); but a general extension from a single point is denied by most writers.

In 1905 I argued in favor of this sort of continuous extension as frequent and important in adults, although far from present in every case of this kind.

Tendeloo,[5] who has done much work in this field, consistently champions the frequency of lymphogenic extension of tuberculosis, both in the case of tuberculosis in different groups of lymph nodes and in the lungs, kidneys, etc.

Recently Straub[6] believes he has demonstrated that tuberculosis often spreads along the lymph vessels, especially in the abdomen, and from lymph nodes there to the spleen and the liver; furthermore, that a communication takes place between the retroperitoneal glands and the thoracic glands and thence to the lungs; that a retropharyngeal infection may spread not only to the uninvolved side of the neck, but also to the superficial cervical nodes and the peritracheal nodes from which the bronchial nodes in the lungs may become infected, and also the peripancreatic nodes; also that the infection in the neck may travel along the deep lymph channels along the anterior surface of the spine down into the abdomen and then extend to other groups of lymph nodes.

It would seem that this mode of extension still should receive consideration, especially in the case of adults, because it is in harmony with what we have learned as to reversal of the lymph stream under pathologic conditions and the establishment of communication between adjacent districts.

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[5] München. med. Wchnschr., 1905, 52, p. 988. Ibid., 1907, 54, p. 105. Handbuch d. Tuberk., 1914, 1, p. 78. Wien. Med. Wchnschr., 1915, 65, p. 321.

[6] Ztschr. f. klin. Med., 1916, 82.

There are, however, also recent investigations which point in a somewhat different direction and indicate that hematogenic infection of lymph nodes is frequent and important in adults. The investigations of the frequency and kind of tuberculosis in childhood by Ungermann,[7] de Besche[2] and myself[1] also point in this direction, and emphasize the frequency of infection in several groups of lymph nodes even in latent tuberculosis.

Oehlecher also believes on the basis of experimental studies that the organs of the chest are regularly infected by way of the blood from other organs, and Selter[8] made experiments on inhalation by animals of small doses, which led him to conclude that the bacilli quickly enter the blood and localize in different places, such as the lungs, bronchial nodes, etc., whatever the point of invasion may be.

At all events it would seem that the hematogenic origin of general lymph-node tuberculosis merits much consideration. The correct explanation of many cases of extensive tuberculosis in the lymphatic system would seem to be that one or more groups of nodes become infected, whereon the process spreads from node to node in that group and eventually to internal organs, thence indirectly to the corresponding lymph vessels and nodes or directly to lymph nodes, which clearly appear to have a distinct affinity for tuberculosis. Experience shows that in childhood, in which the cases here considered most frequently occur, the infection spreads very easily, especially to the blood and blood vessels. Marked infection and rapid extension would give rise to general lymph-node involvement, which apparently is continuous and simultaneous. This explanation is especially applicable to tuberculosis early in life (as is shown in investigations by Ungermann,[3] de Besche,[2] and myself[1]), and probably also to many cases of extensive and general lymph node tuberculosis in adults.

The question arises why tuberculosis in certain cases does not stop and is not arrested and cured, but relentlessly and steadily advances. The explanation might be the virulence of the bacilli. It is true that probably most instances of this kind of tuberculosis are caused by bacilli of the human type and the frequent statements in the history that a parent had tuberculosis certainly points in this direction, but as yet we do not know anything very definite about the different actions of tubercle bacilli of the bovine and of the human type, even though it appears to be true that the bovine bacilli as a rule are not especially virulent. It would perhaps be more reasonable to look for the explanation in repeated infections in connection with a lowered resistance.

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[7] Tuberk.-Arb. a. d. k. Gsndhtsamte, 1907, 7.

[8] Deutsch. med. Wchnschr., 1916, 42, p. 77.

What then is the consequence of this general infection of the lymph nodes? As pointed out, tuberculosis is the cause of death in the majority of cases, associated with various secondary localizations. Miliary tuberculosis or tuberculous meningitis developed in one fifth of all the cases, tuberculosis of the intestinal tract in also one fifth of all the cases; tuberculosis in the genitalia, the serous membranes, bones, and joints all occurred, although rarely a general marasmus; chronic pulmonary tuberculosis developed in 12 of this series of 30 fatal cases, that is, 40%. Transition forms or mixtures with leukemic conditions and lymphosarcoma may also be encountered.

Again the question arises whether the pulmonary tuberculosis is secondary to the old lymph node process or whether it perhaps is due to a new infection of the lungs by inhalation of tubercle bacilli. My opinion is that most of these cases of tuberculosis of the lungs are derived from the tuberculosis in the lymph nodes either by direct perforation into the lungs, as seen so commonly in children, or due to a hematogenic infection for which there is abundant opportunity in the course of years.

This leads us to a problem of great interest just now and of great practical importance, namely, whether pulmonary tuberculosis in adults is due to a tuberculous infection in childhood, a continued hematogenic infection or autoreinfection, or on the other hand to a new infection during the adult period. The first possibility has been championed by Andvord in Norway and Römer, Much, and Hamburger in Germany, on the basis of the frequent and regular infection in childhood, which is assumed to have a relatively immunizing effect, which in turn has been thought to influence the character of tuberculosis in adult life.

I intend to limit the discussion to the principal points of the investigations in this field and especially to the views advanced by Andvord.[9] In his last article he claims that in about two thirds of all cases infection takes place in childhood and that tuberculosis of the lungs, manifest as well as latent, in adults must be traced back to childhood infection. At least one fourth of all adult tuberculous patients have been 'scrofulous,' and the lung process is a further development of the early infection, probably most frequently by way of the blood. The point of departure is most often an old tuberculosis in the lungs and bronchial nodes, probably originally introduced by way of the air. In districts and town in which tuberculosis has existed for generations only 20-30% of the cases of fatal tuberculosis in adults are acute primary infections; in 80-70% the infections may be assumed to have arisen in childhood, but the majority of the early infections are mild, only 10-5% cause later a fatal pulmonary tuberculosis.

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[9] Norsk Mag. f. Lägevidenskaben, 1912, 73, p. 1609.

From the clinical point of view, Tillisch has attempted to solve the same question by a study of 841 patients of Grefsen Tuberculosis Sanatorium. In about 20% there had been exposure to infection in childhood, while according to the history about 80% were infected outside the home. Clinically demonstrable indications of an infantile infection was found only in 29% of the 20%, but the other patients, whose history gave no information as to the source of infection and who had symptoms of tuberculosis in childhood, increased the number of those who had had tuberculosis early in life to 156, that is, 18½% of 841 tuberculous patients. The latency, however, was often very long, so that it is difficult to understand the connection. The results of the work by Tillisch indicate, however, that an auto-infection must be assumed in some cases while in other cases an infection from the outside or reinfection in adult life must be assumed.

Tillisch holds that his experience in regard to the dependence of a certain amount of pulmonary tuberculosis in adults on infection in childhood is supported by the history of the cases, and also the fact that tuberculous children often die of tuberculosis. He expresses regret that the study of the pathologic anatomic changes have not supplied any evidence in favor of the origin of tuberculosis of the lungs in adults in infantile infection, but he overlooks my treatment of this question.[1]

Of 558 postmortem examinations in adults in 1901-1902, there were 124 deaths from tuberculosis, that is, 22.2%. There were 30 cases with primary extensive lymph node infections, death resulting from tuberculosis in other organs (24% of the fatal cases of tuberculosis), the point of origin being most often the bronchial lymph nodes or a general lymphatic process, not rarely the cervical or mesenteric glands. On the basis of this result, I estimated that 15-20% of all cases of pulmonary tuberculosis in adults arose secondarily, presumably by way of the blood, from other organs, especially the lymph nodes. I have now collected the reports of cases for 1904-1915, 2911 postmortems with a tuberculous death rate of 14.7%. There were 219 cases of death from tuberculosis of the lungs in adults, of which in 39, that is, 18%, the anatomic picture clearly pointed to a tuberculous infection in childhood. Most often there was an old primary tuberculosis of the lymph nodes with various other internal localizations, in about 50% a general lymph-node tuberculosis (16 cases), tuberculosis of the bronchial nodes (8 cases), of the cervical nodes, the cervical and bronchial nodes, and rarely in the thoracic and abdominal nodes. In addition, primary old tuberculosis in lymph nodes was frequent, especially the general, in which there were found at the same time small foci in the lungs, healed pleuritis, etc., but in which the fatal localization was different.

Hence the figure reached from purely anatomic consideration corresponds to my earlier observations and also fairly closely to the results obtained by Tillisch from data of a different kind.

The question might be raised whether the tubercle bacilli which for many years have been present in latent forms in the lymph nodes preserve their virulence so that they actually give rise to infection. My experiments with inoculations in guinea-pigs with resulting fatal tuberculosis are comparatively few, but all indicate that the virulence is retained unchanged. Such was the result reached also by Bugge[11] from his numerous inoculations of old tuberculous foci in the lungs and bronchial nodes. It would seem then that in about one fifth of all cases of pulmonary tuberculosis in adults one can demonstrate anatomic changes which originated early, probably most often in childhood, and which may have been the source of later infection, eventually of the process in the lungs — hence of autogenous or endogenous infection or reinfection. If this is the case, does it contraindicate the modern view that most tuberculosis late in life, for example, in the lungs, kidneys, bone, and the joints, has the same origin, especially because earlier infections in childhood are assumed to have left behind a relative immunity or increased resistance to new infection? This would probably be a hasty and incorrect conclusion because it is only tuberculous infection with marked and advanced anatomic changes that we have considered; the milder latent infections of childhood, demonstrable by systematic inoculations of lymph nodes or by tuberculin tests, which are present in most children, are not included, and there is no ground to doubt that such infections also influence the organism, possibly in the way of increased resistance. In regard to this point these investigations do not furnish any information and consequently I do not now wish to consider further the Andvord-Römer hypothesis.

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[11] Undersökelser om lungetuberkulosens hyppighed og helbredlighet, 1896.